REMARKS

Reconsideration of the above-identified application in view of the amendments above and the remarks following is respectfully requested.

Claims 1-7, 9, 10, 12-15, 17, 18, 20-23, 25, 26 and 28-36, 38 and 39 have been rejected under 35 U.S.C. § 102(b) as being clearly anticipated by Akiyama et al. US 5,883,720. Claims 11, 19, 27 and 40 have been rejected under 35 U.S.C. § 103(a) as being rendered obvious over Akiyama.

1) Amendments made

In the present amendment, claim 1 has been rewritten to include the limitation that the analyzer comprises two components, a spectral analyzer and an orthogonal transform calculator. The spectral analyzer operates on the output of the intensity detector to produce a spectrum that gives intensity levels for each wavelength. The output of the spectral analyzer is then fed to the orthogonal transform calculator which carries out an orthogonal transform on the intensity spectrum. The output of the orthogonal transform gives data which can be interpreted to give layer thicknesses over the wavelength. The output is not spatial, since the thicknesses measured may be of layers that are continuous over the entire surface. Alternatively the layers may be discontinuous over the entire surface, including being present at multiple locations over the surface.

The claim also now refers to a substrate having multiple layer thickness values.

The output non-spatial data is then used in a comparison process to determine the routing of the part product.

2) Claims Rejections USC 102

In order to find a lack of novelty, it is necessary to find each and every component of the claim either present in a document or clearly implied by the document such that a person skilled in the art would have no doubt that such a feature is present. The present amendment is drafted to ensure that the claim positively delimits to features clearly not present in Akiyama.

Akiyama indeed obtains a spectrum of intensities of reflections from a layered substrate. It further uses the spectrum to determine a thickness of the one or more layers that are continuous over the substrate, or for that matter the tolerance in the thickness of the layer(s) over the substrate. Akiyama obtains the thickness *directly from the spectrum* by finding wavelengths at which the spectrum has respectively maximal and minimal peaks– see Akiyama Fig. 3. The thickness is directly derivable from these wavelengths without any need for orthogonal processing, but see below for our comments on Akiyama's Fig. 2. Reference is made to column 9 lines 45 to 67, where it is made abundantly clear that the derivation of Akiyama is carried out *directly from the wavelength*. All that is necessary for a computer to work from the spectra of Akiyama is for A D conversion of the spectrum. Thus column 10 line 58 of Akiyama states clearly that a difference of 20nm in wavelength represents a 5% tolerance in the layer thickness. That is to say, layer information is derived *directly from the spectrum* and no transformation *of any kind*, orthogonal or otherwise is disclosed or even suggested by Akiyama. Furthermore, in the full flowchart of Fig. 1 of Akiyama it is made abundantly clear that data is derived *directly from the wavelengths* and no orthogonal transformation *of any kind* is carried out.

Akiyama does not need to carry out any transforms because, in the case of a continuous layer over the entire substrate surface, *all* the information required is

derivable *directly* from the spectrum. For the multiple layer multiple thickness case which he shows in Fig. 2, see below.

Once again it is stressed that Akiyama clearly discloses derivation of thickness data *directly* from the wavelength values, and no kind of orthogonal processing *of any kind* is even hinted at. There is no need to carry out orthogonal processing to obtain wavelength values from a spectrum. The wavelength values used for the thickness calculations of Akiyama are *clearly present in the spectra* obtained, for example the spectrum shown in Fig. 3 of Akiyama where a maximum peak at 400nm and a minimum peak at 600nm is shown. These wavelength values are used *directly* in *each* of formulae 1 – 5 of Akiyama.

The Examiner states in his rejection "therefore the spectroscope detects the spectral reflectance, performs a transform on the detected signal and outputs data for analysis to the computer of Akiyama et al."

It is respectfully submitted that Akiyama does *not perform a transform on the spectral reflectance derived by the spectroscope*. As clearly shown in each of equations 1 through 5 of Akiyama, values *directly present in the spectrum* are used throughout, and there is no disclosure of nor even a hint of carrying out a transform.

It is therefore respectfully submitted that no issue of novelty arises in respect of Akiyama.

Figure 2 of Akiyama in fact does show an optical recording medium having multiple layers. Thus on the face of it Akiyama does make measurements of multiple layers which are continuous over the substrate, although there is no suggestion that he measures discontinuous layers. However it is believed that the method of Akiyama would not in fact succeed in providing an accurate result for the case of his Figure 2 for the following reason. The sample of Akiyama Fig. 2 has multiple layers of

different materials and each layer has multiple thicknesses. Each of the layers thus generates a reflection function as a function of wavelength of its own, and each thickness within the layer in fact generates its own function. Altogether when the combined function of all the layers is subsequently compared with a reference function, it is not believed to be feasible to find out from the difference which layer and which thickness within a layer have changed. That is to say, the result for multiple layers is far from the simplified graph of Fig. 3 and it is doubtful that Akiyama could obtain useful information therefrom in the multiple layer multiple thickness case.

3) Claims Rejections and USC 103 Inventive Step

The reason that Akiyama does not carry out any kind of transformation is that the thickness information of a single layer present continuously over a substrate is directly derivable from the spectrum. A certain wavelength has its intensity boosted by constructive interference due to reflection from either layer boundary. One simply needs to determine what that frequency is and the layer thickness can be known.

By contrast, the present invention concerns semiconductor wafer type products wherein surfaces are patterned. As a consequence, certain layers are continuous. Other layers are of variable thickness over the surface of the substrate. Other layers are discontinuous, that is present at discrete locations over the substance. Any combination of such layers is likely to be present on substrates with which the present invention is concerned. The method of Akiyama, which derives thickness information directly from the spectrum, would fail under such circumstances.

That is to say Akiyama fails to suggest any way in which complicated layer thickness information should be derived from the intensity spectrum. Although, as mentioned above, Akiyama does show a multiple layer, multiple thickness situation in

Fig. 2, the situation does not correlate with the two-peak graph shown in Fig. 3 and it is not clear how Akiyama can deal with the situation in Fig. 2.

Nagoshi, which is cited by the Examiner to show that ordinarily, spectral analysis is supplemented by Fourier analysis, in fact teaches away from the invention. Nagoshi teaches Fourier processing of the spectrum to obtain *spatial* information, see column 8 line 65 of Nagoshi. However, for discontinuous layers being present at discrete locations over a substrate, a spatial analysis would be unhelpful since it would show all of the discrete locations as separate data making the result unusable. For example on a million+ transistor processor, each of the million transistors would give a *separate* peak which would have to be considered separately. The Examiner will appreciate that separate consideration of such a large number of peaks is neither feasible nor is it especially relevant to monitoring the performance of layer deposition operations.

Indeed, Nagoshi underlines the substantial prejudice in the art against using Fourier processing for layer thickness detection in wafer manufacture. It was generally believed in the art that Fourier analysis gave a spatial result and was therefore useless in the circumstances of wafer manufacture.

There is thus no motivation present in the art to add the Fourier analysis of Nagoshi to the spectral analysis of Akiyama, which does not use Fourier analysis, in order to derive a measurement system for multiple thickness surfaces.

In summary, to the best of applicant's knowledge, there is no prior art which discloses a method or apparatus for measuring multiple thickness substrates which uses orthogonal processing of intensity spectral data in order to derive the thicknesses. There is certainly no art which suggests using the results of such an analysis in a

comparison to route wafers in a multiple station manufacturing process. Indeed there is substantial prejudice in the art against doing so, as exemplified by Nagoshi.

Thus it is respectfully submitted that the main claims comprise an inventive step over the prior art and are thus allowable.

The dependent claims are believed to be allowable as being based on allowable main claims. No new matter has been added by virtue of the above amendments.

It is thus respectfully submitted that all of the issues raised by the Examiner are overcome by the present amendments.

In view of the above amendments and remarks it is respectfully submitted that all the pending claims are all now in condition for allowance. Prompt notice of allowance is respectfully and earnestly solicited.

Respectfully submitted,

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